

High pressure water jetting (decontamination)

Nuclear Power Plant Philippsburg
Germany

Wasserhochdruckdekontamination in KKP
EnKK PUS
Hellmann
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Nuclear Power Plant Philippsburg (KKP1, KKP2)



Purposes

- to clean out deposits (incrustation)
 - decontamination
 - reduction of dose rate
-
- maintenance: must not damage material (surface)
 - dismantling: may damage surface

3 Types

- built-in: (PWR)
- mobile; plant equipment
- mobile; rent equipment



Built-in Decontamination System PWR

➤ decontamination of vessels

➤ 50 bar, up to 90°C

➤ chemicals may be used

➤ components:

- mixtank
- decont pump
- drainage pump
- filter
- tank cleaning heads, hoses
- fittings, covers



Mobil plant equipment

> Falch:

- robust
- up to 400 bar
- 27 l/min.



> Kärcher:

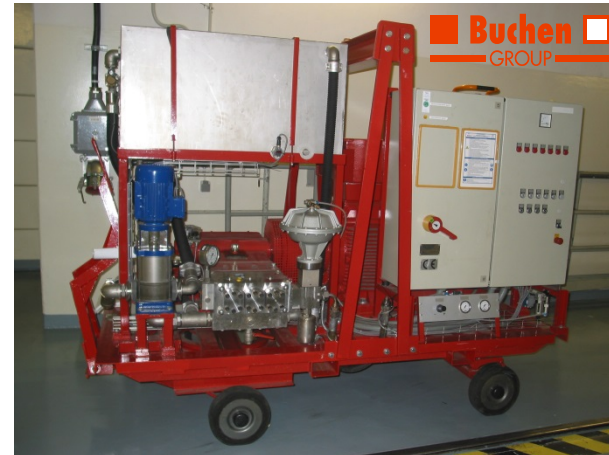
- 30 bar to 150 bar
- up to 85°C
- mixtank for detergents
- 15l/min.



Rent mobile equipment

> pumps:

- electric
- storage tank
- adaptation to controlled area
- deionate or boron water
- 50 – 900 bar
- 90 l/min
- Also available: on truck



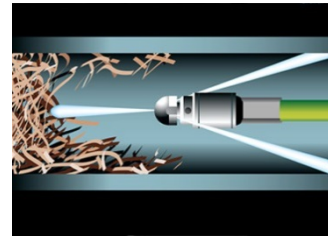
Equipment

> tank cleaning heads

- water driven (70l/min; 50bar)
- electrically / pneumatically rotating



> nozzles:



> lances, guns:



> hoses, couplings:



Additional Equipment

➤ special cover



➤ check valve



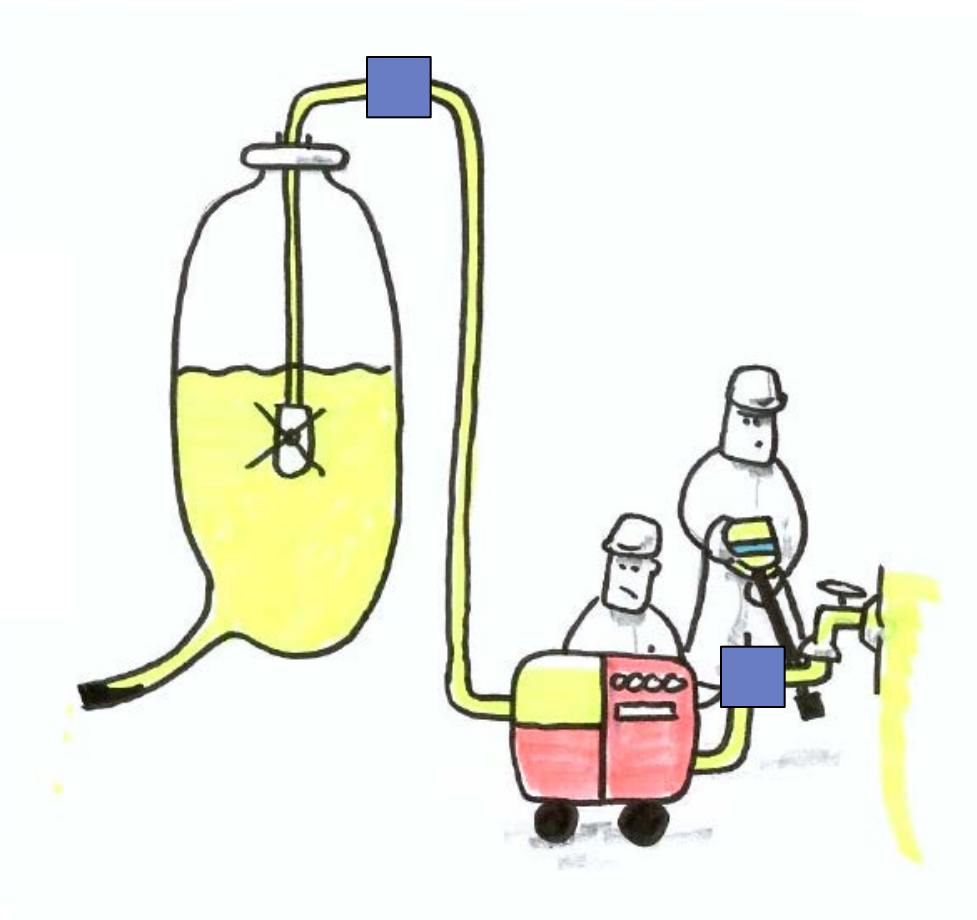
Additional equipment

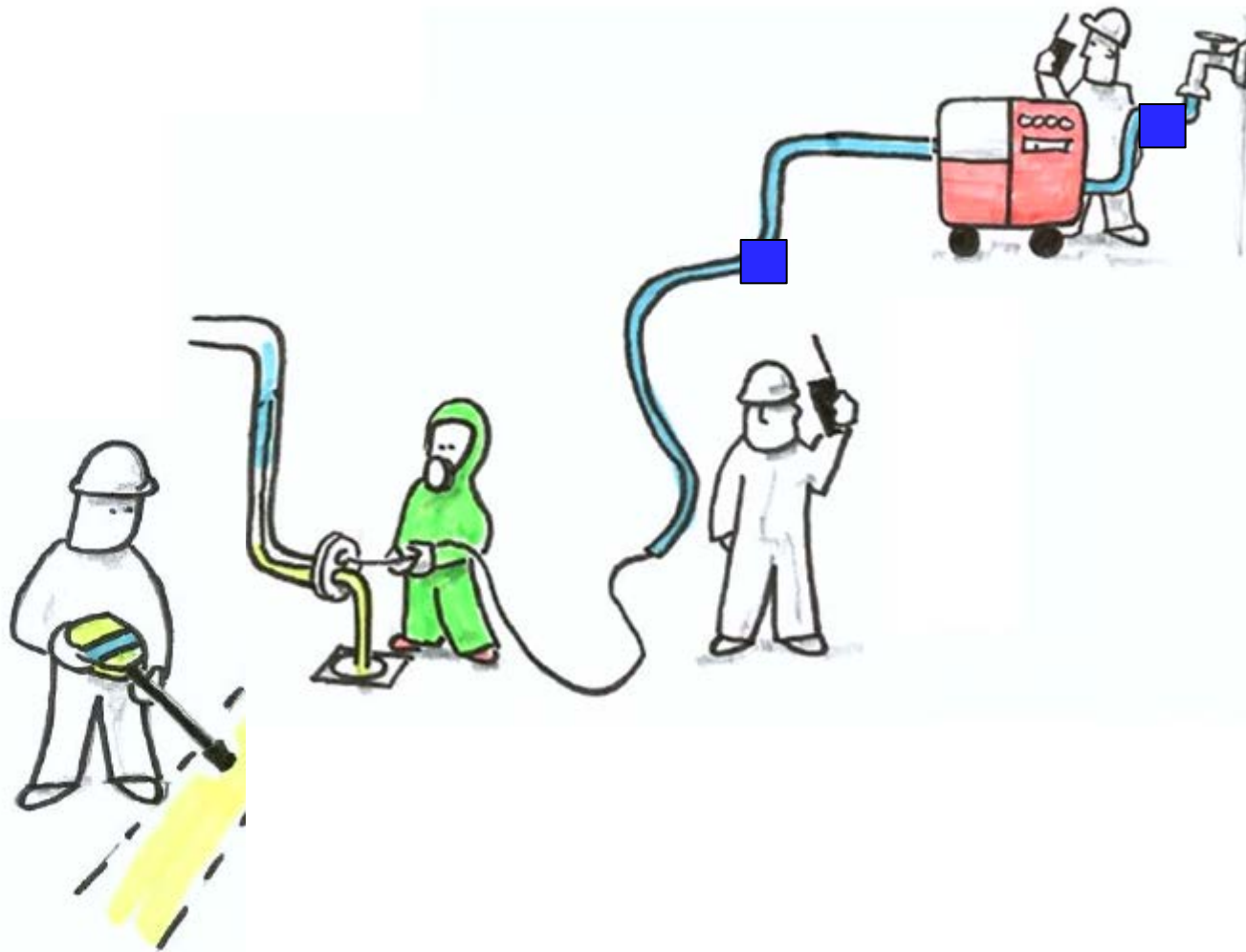
> PPE:



— EnBW







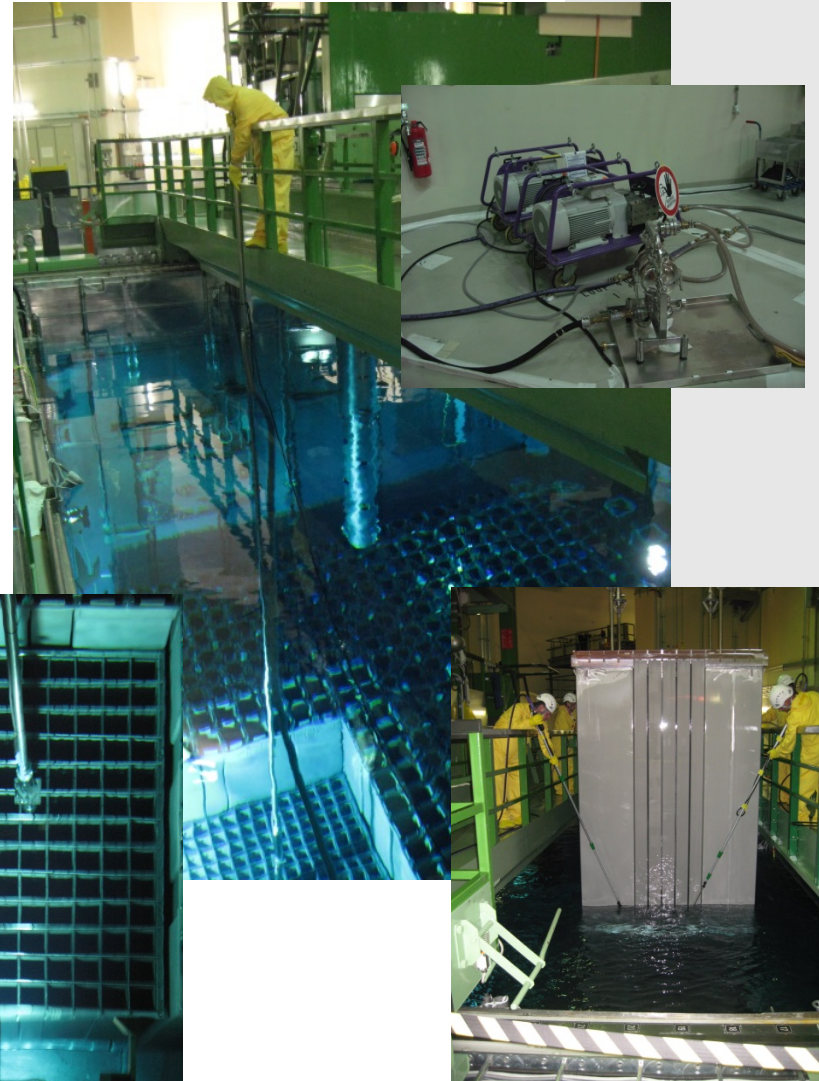
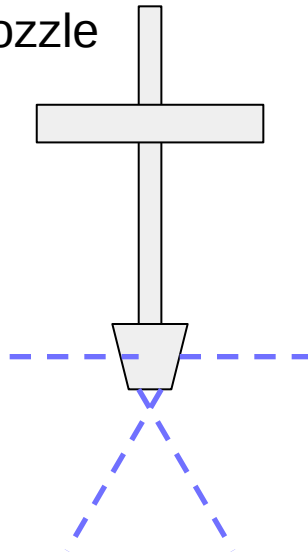
Example: built-in system PWR

- decontamination: storage tank for primary water
- tank bottom: before 1200 $\mu\text{Sv/h}$
after 100 $\mu\text{Sv/h}$
- manhole: before 450 $\mu\text{Sv/h}$
after 250 $\mu\text{Sv/h}$



Example: mobile plant equipment; BWR Fuel Rack

- under water jetting
- removing of SCRUD and contamination
- special nozzle



Rent mobile equipment: Steam Generator PWR

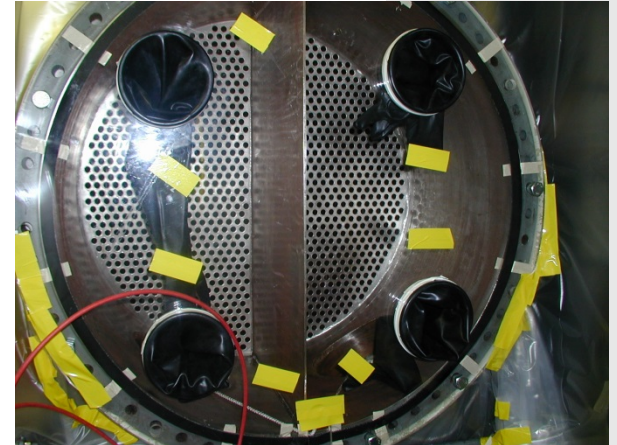
- reduction of contamination
smears before: 1000 $\mu\text{Sv/h}$
smears after: 100 $\mu\text{Sv/h}$
- no effect on doserate
- effect:
less risk of spreading contamination
- dose: about 400 man μSv



Rent mobile Equipment: Heat Exchanger, Evaporator

> heat exchanger:

- purpose = removing incrustation / decontamination
- smears: $120 \mu\text{Sv/h}$ -> 250 Bq/cm^2
- dose: 300 man μSv



> evaporator:

- purpose = removing incrustation
- $2000 \mu\text{Sv/h}$ -> $1000 \mu\text{Sv/h}$ shielding pot
- dose: 2 man mSv



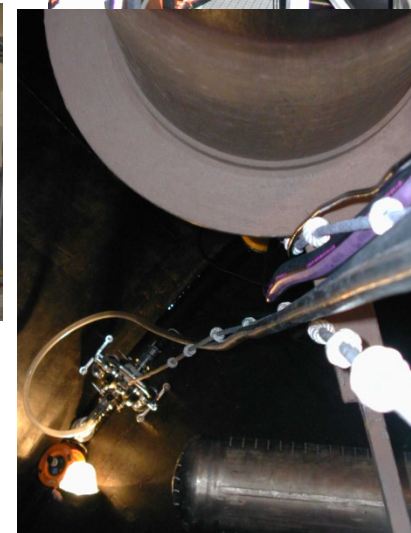
Rent mobile equipment: Decontamination of Wetwell BWR



- tank cleaning heads (2)
- Pumps (2)
- Lances
- pneumatic pumps

- doserates in $\mu\text{Sv/h}$:
 - entrance: before 25 after 5
 - gangway: before 30 after 15
 - pipes: before 100 after 20
 - bottom: before 150 after 25

- benefit:
 - about 700 man mSv (dismantling)

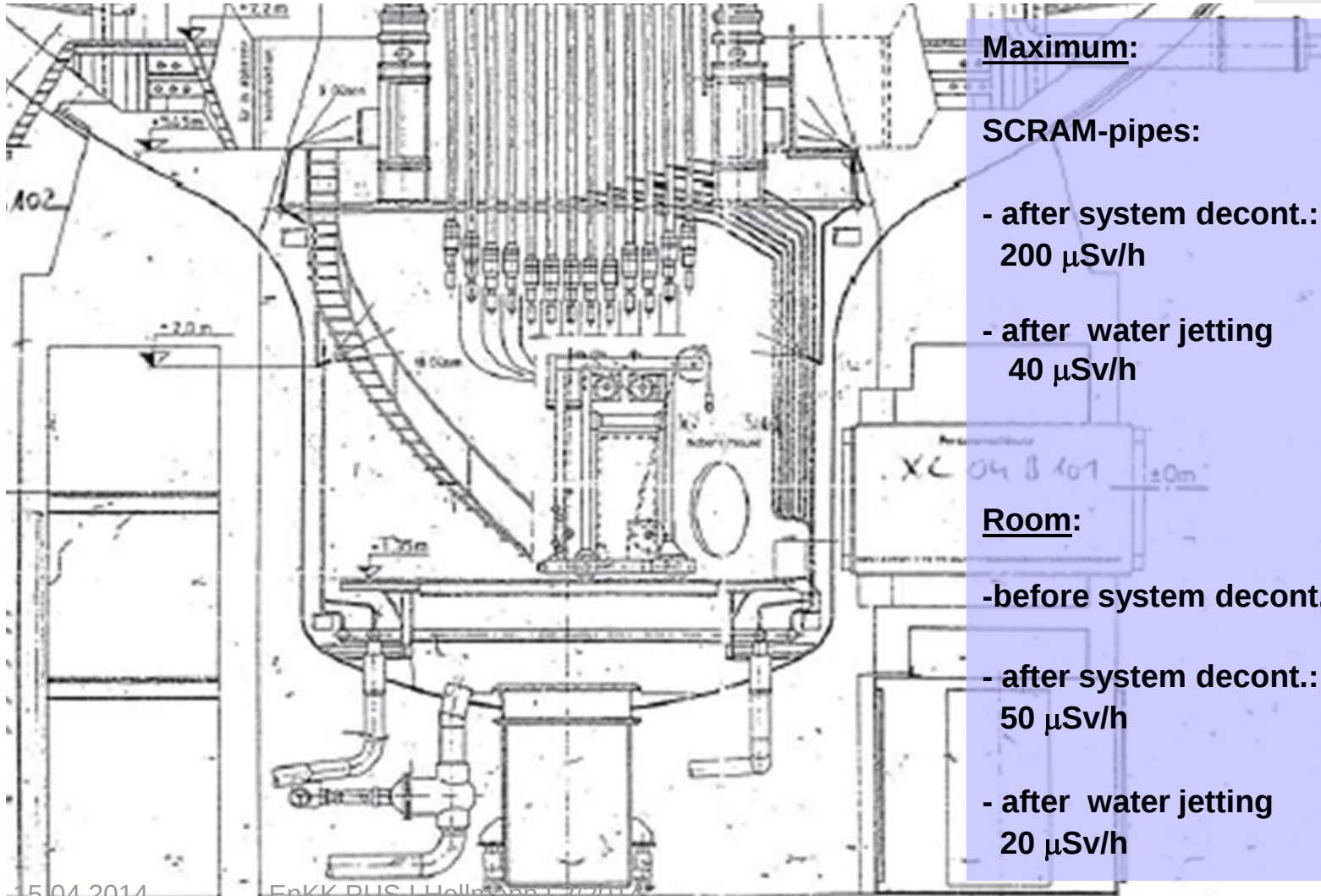


Following to a (Full) System Decontamination

- dead branches / dead legs: increased dose rate
- result: higher doses for following work



Following to a (Full) System Decontamination Control rod room



Maximum:

SCRAM-pipes:

- after system decont.:
200 $\mu\text{Sv/h}$
- after water jetting
40 $\mu\text{Sv/h}$

Room:

- before system decont.:
50 $\mu\text{Sv/h}$
- after system decont.:
50 $\mu\text{Sv/h}$
- after water jetting
20 $\mu\text{Sv/h}$

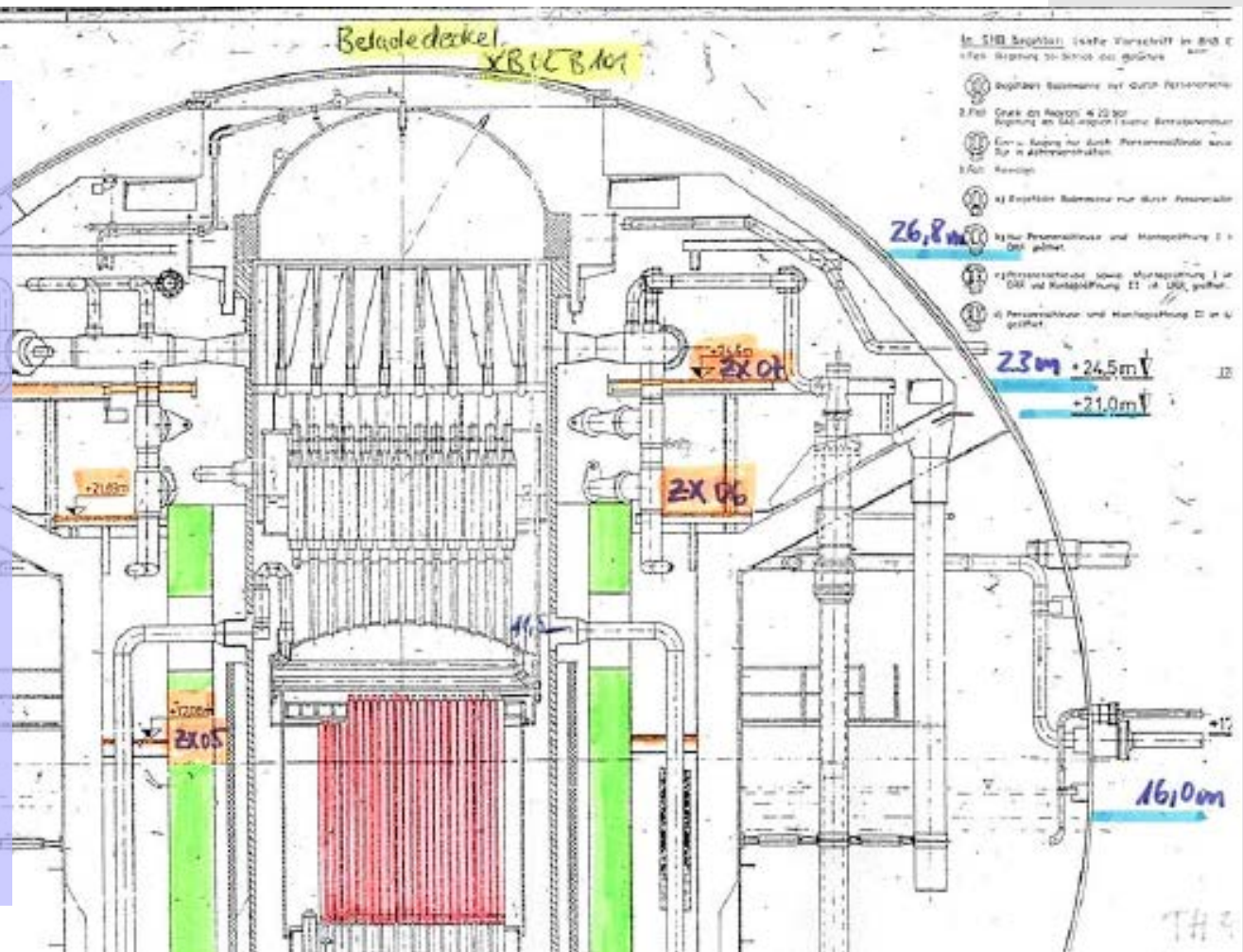
Following to a (Full) System Decontamination Containment Main Steam Pipes

Maximum: steam-pipes

- after system decont.:
1200 $\mu\text{Sv/h}$
- after water jetting
150 $\mu\text{Sv/h}$

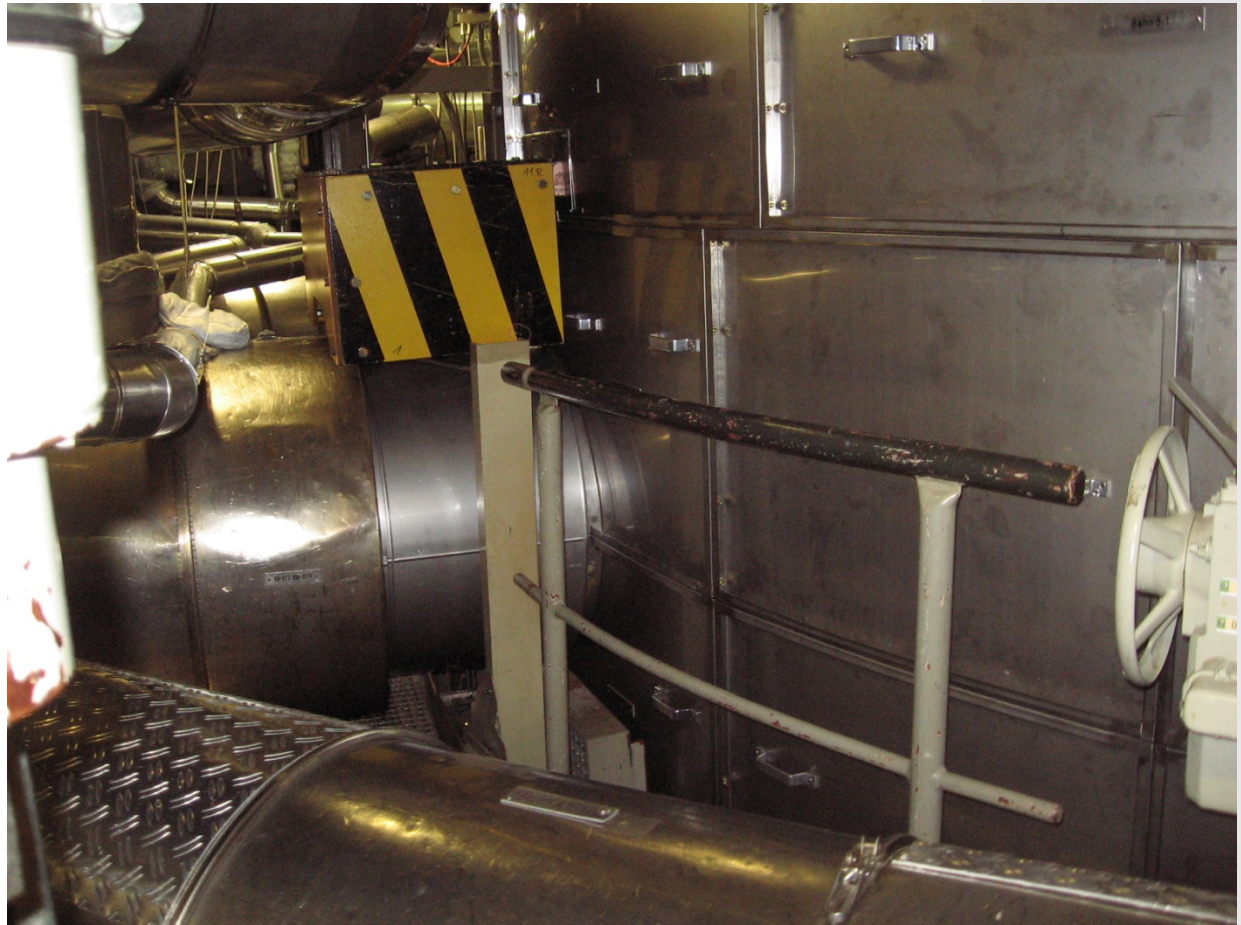
Room:

- after system decont.:
70 $\mu\text{Sv/h}$
- after water jetting
20 $\mu\text{Sv/h}$



Following to a (Full) System Decontamination

- dose: 4 man mSv
- benefit:
about 1man Sv
(dismantling)



Experiences

- a good way to reduce contamination and doserate
- not efficient for systems that were operated with higher temperature and pressure
- define the flow of the water
- check the flow of the water (doserate, level)
- have experienced workers
- define PPE according to the workplace
- use proofed machines and equipment
- use check valves
- use special covers
- Tank Cleaning Heads must not drown

**Vielen Dank für
ihre
Aufmerksamkeit**